

# 9x15 Low Speed Wind Tunnel Improvement Update and Plans

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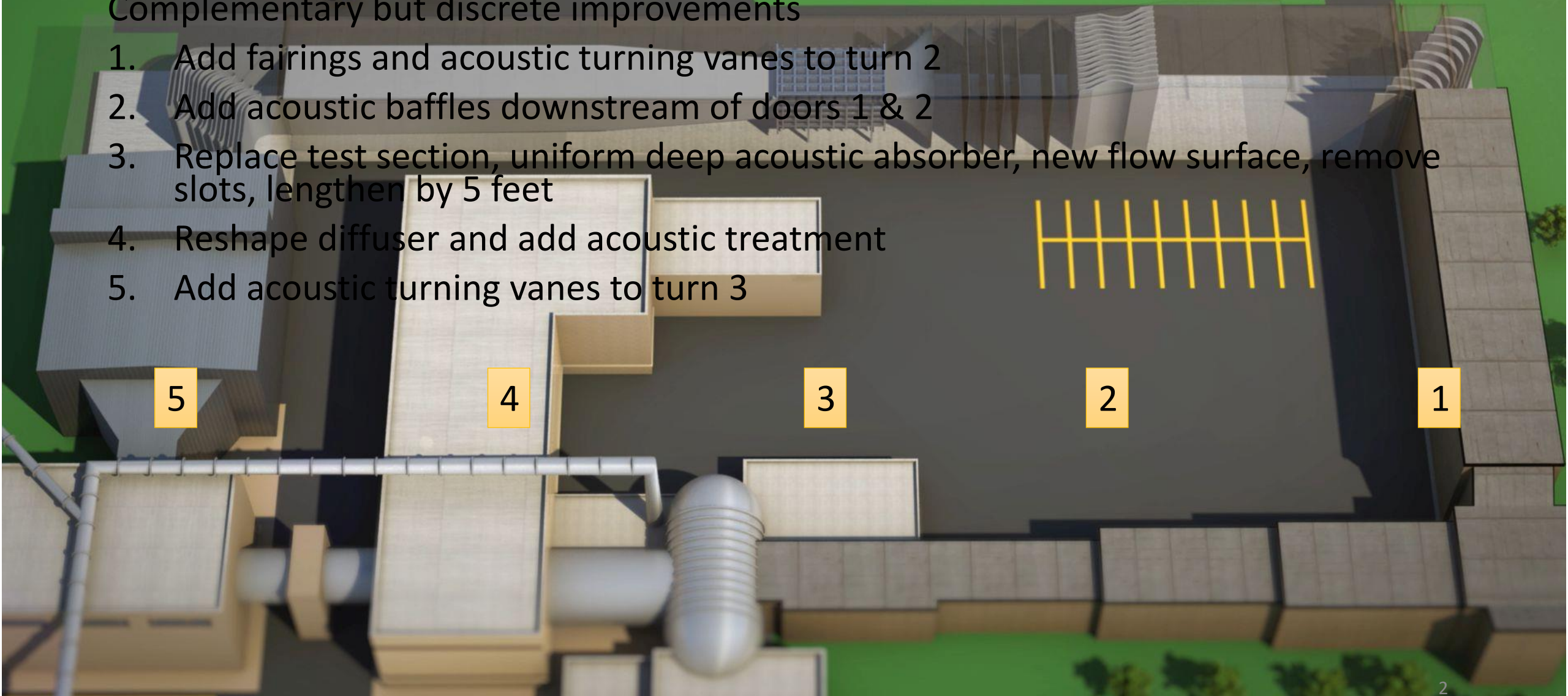
This work has been funded by the

- NASA Advanced Air Transport Technology Project
- NASA Aeronautics Evaluation and Test Capabilities Project

# 9x15 Wind Tunnel Upgrades

Complementary but discrete improvements

1. Add fairings and acoustic turning vanes to turn 2
2. Add acoustic baffles downstream of doors 1 & 2
3. Replace test section, uniform deep acoustic absorber, new flow surface, remove slots, lengthen by 5 feet
4. Reshape diffuser and add acoustic treatment
5. Add acoustic turning vanes to turn 3





Turn 2

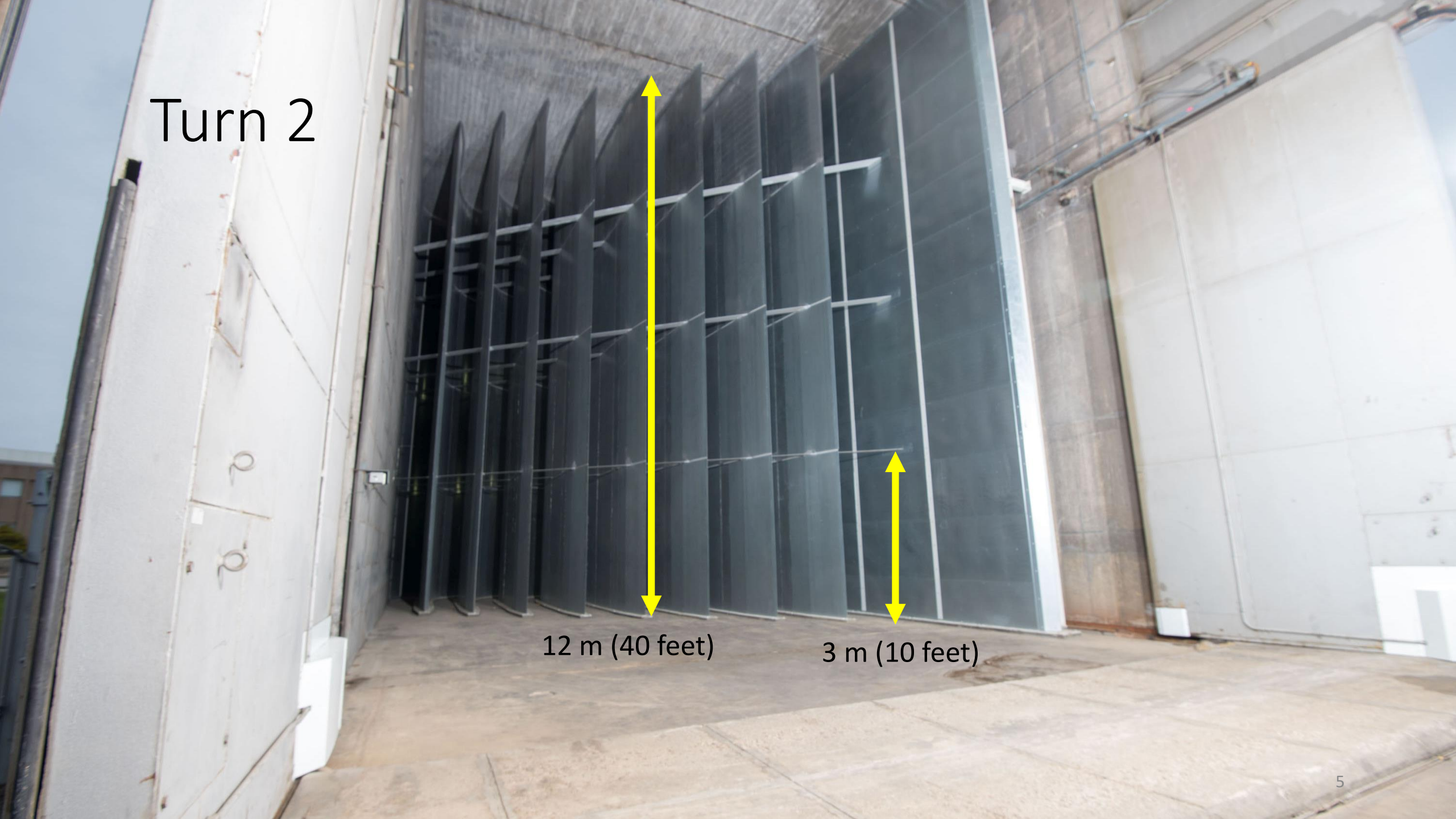




Turn 2



Turn 2



12 m (40 feet)

3 m (10 feet)



# Test Section (2016)



# Test Section (2016)





# Test Section

2.7 x 4.5 m  
(9 x 15 feet)




The image shows the interior of an acoustic chamber. The walls and floor are covered in light-colored plywood. A metal frame, consisting of a vertical post and a horizontal bar, is positioned in the center. To the right, there is a dark, perforated metal screen or partition. The lighting is somewhat dim, and the overall appearance is that of a laboratory or testing facility.

Upstream  
Diffuser

**Acoustic Results PRELIMINARY**



# Downstream Diffuser



6.4 x 5.8 m  
(21 x 19 feet)



Turn 3





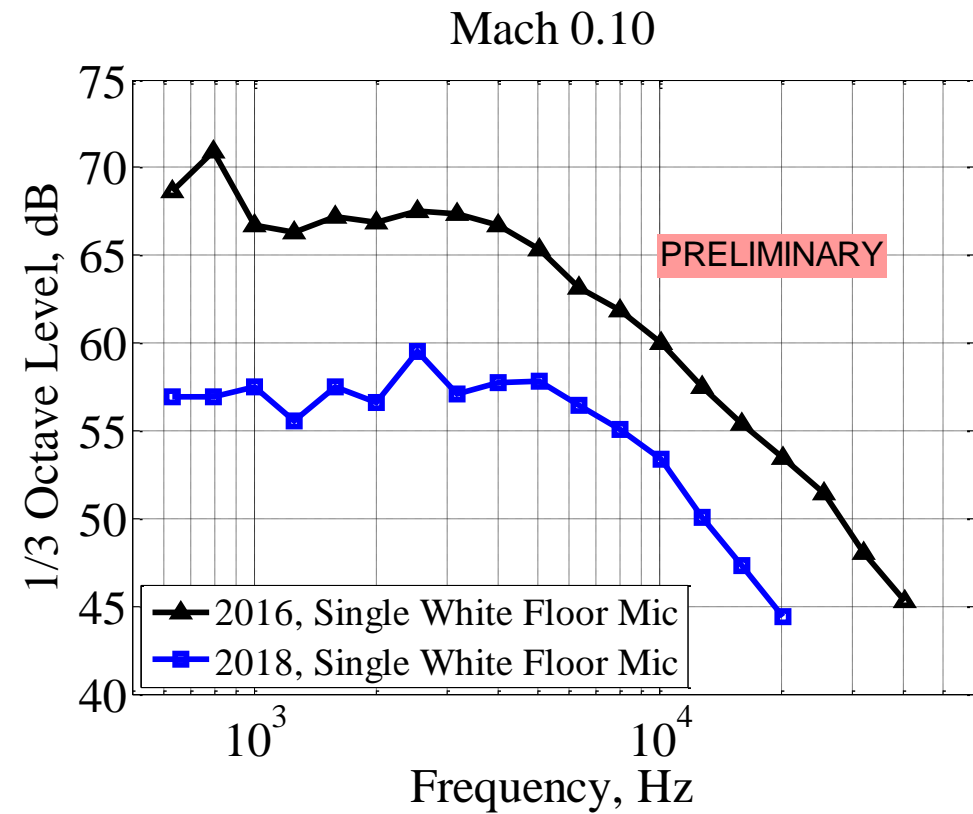
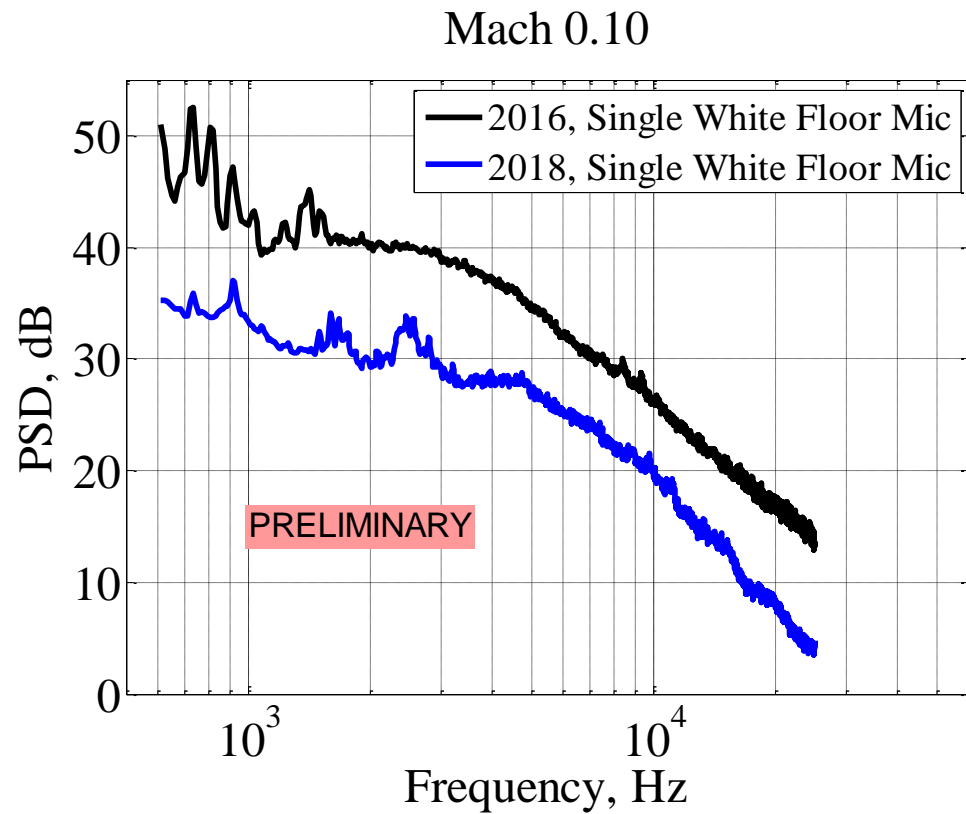
# Piggyback During Integrated System Test

- Other upgrades
  - Tunnel control system
  - Steady-state data system
  - Pressure measurement system
- Operation over full tunnel range demonstrated
- Pressure drop and gain balance
- Improved temperature uniformity



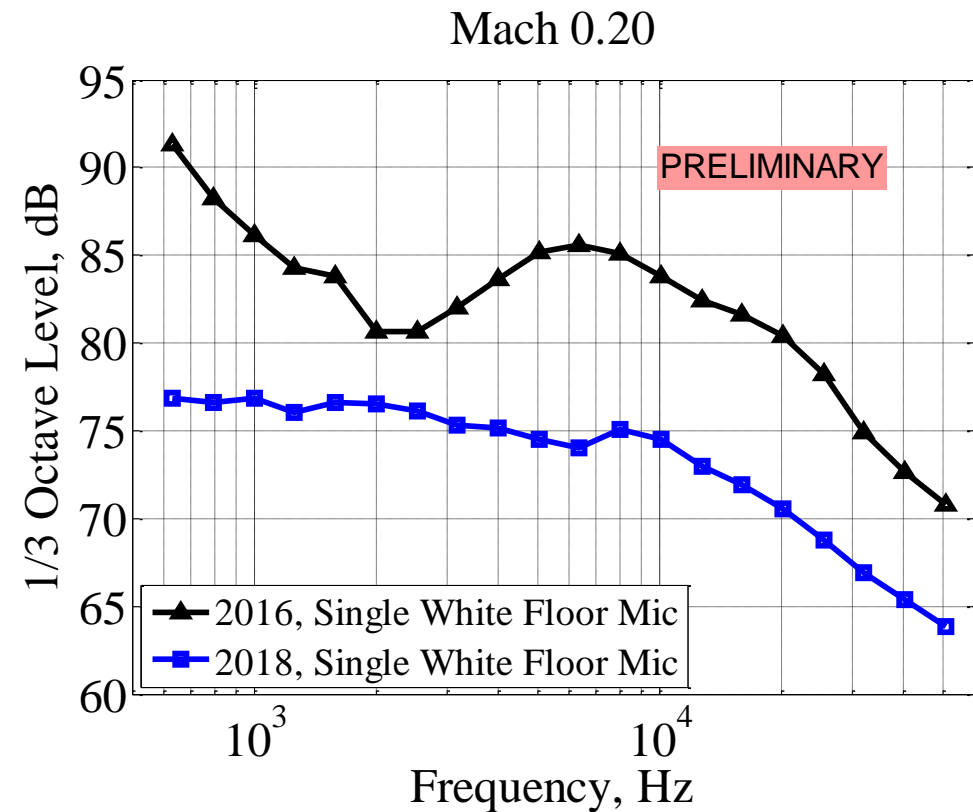
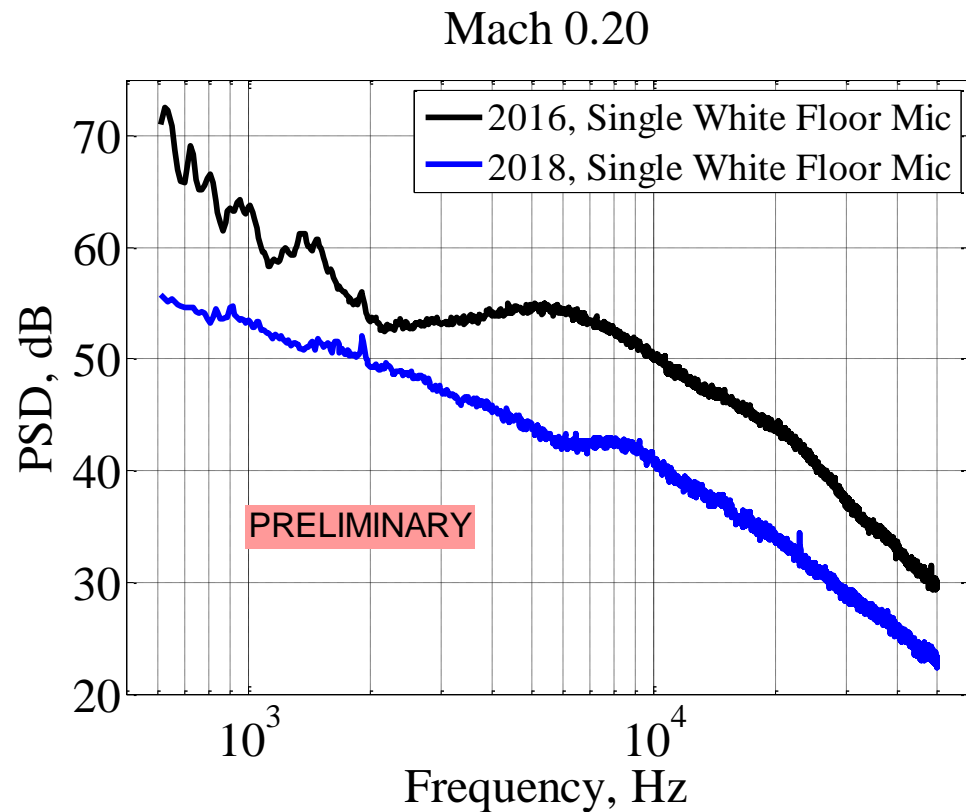


# How'd we do, Mach 0.1?



# How'd we do, Mach 0.2?

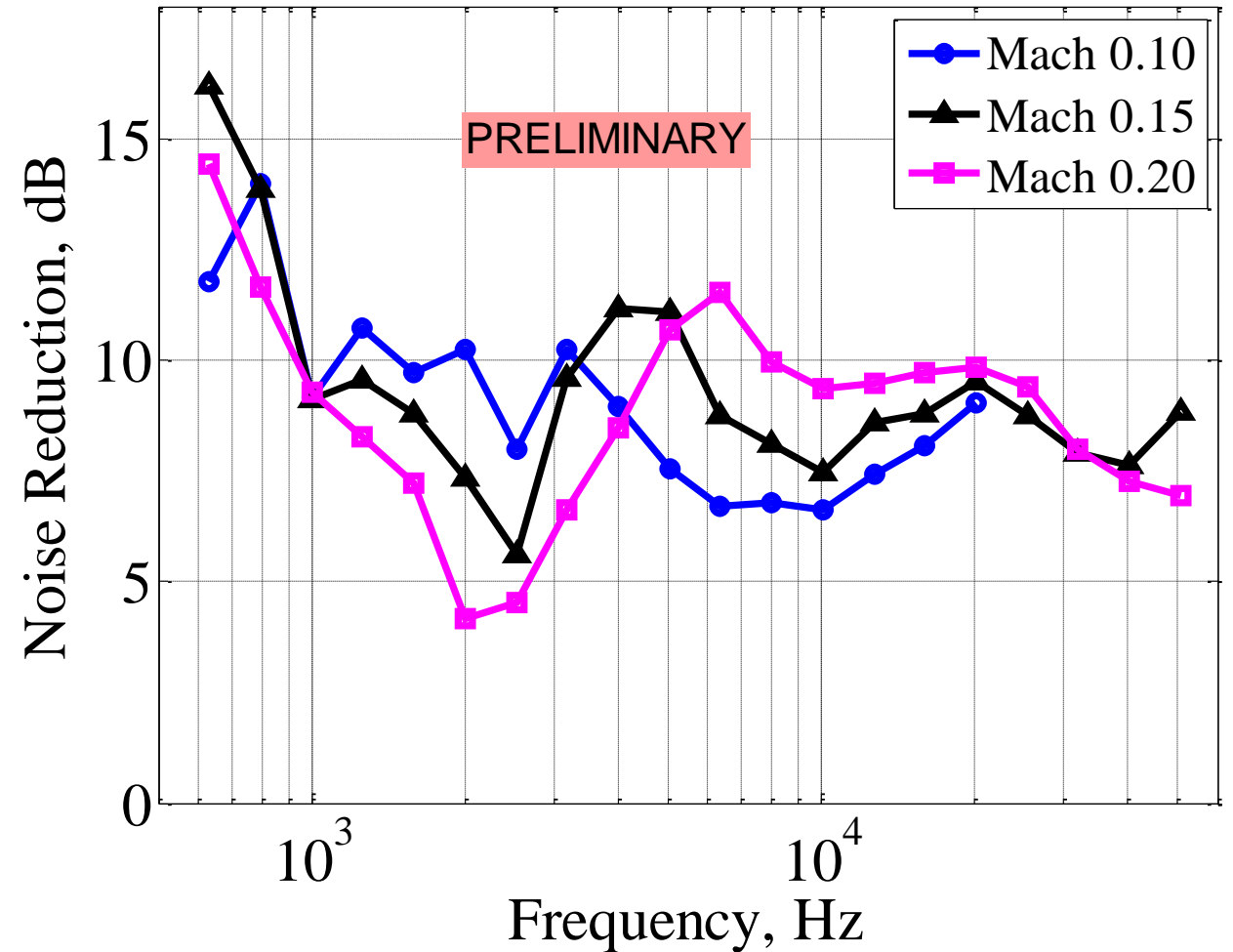
20 dB axis shift  
from previous slide





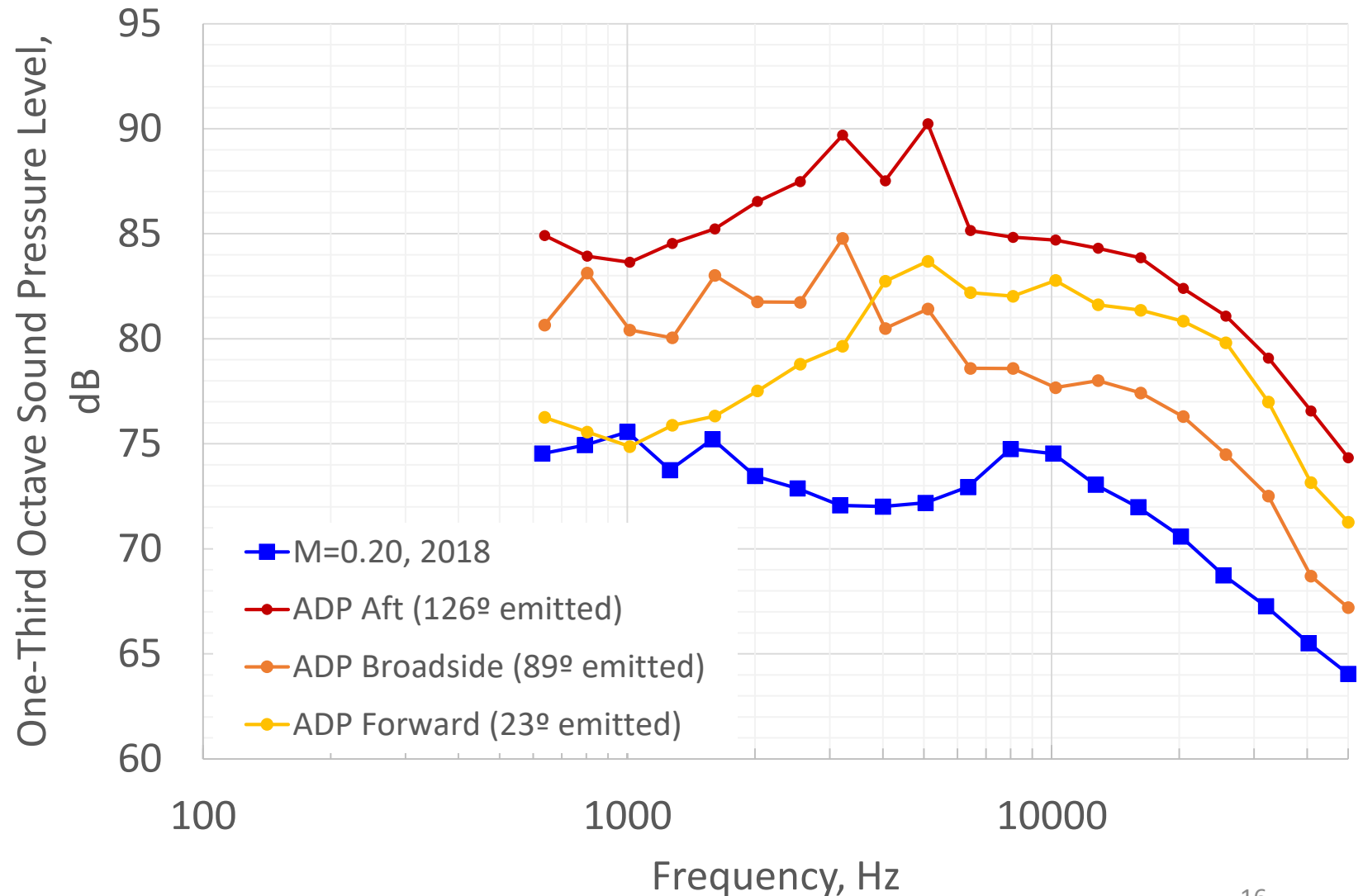
# Total Noise Reduction

- Frequency dependent
  - 12 dB at 630 Hz
  - 8 dB at 50 kHz
- Tunnel Speed Dependent
  - 4-10 dB at 2 kHz
  - 5-11 dB at 7 kHz



# Implications for Fan Testing

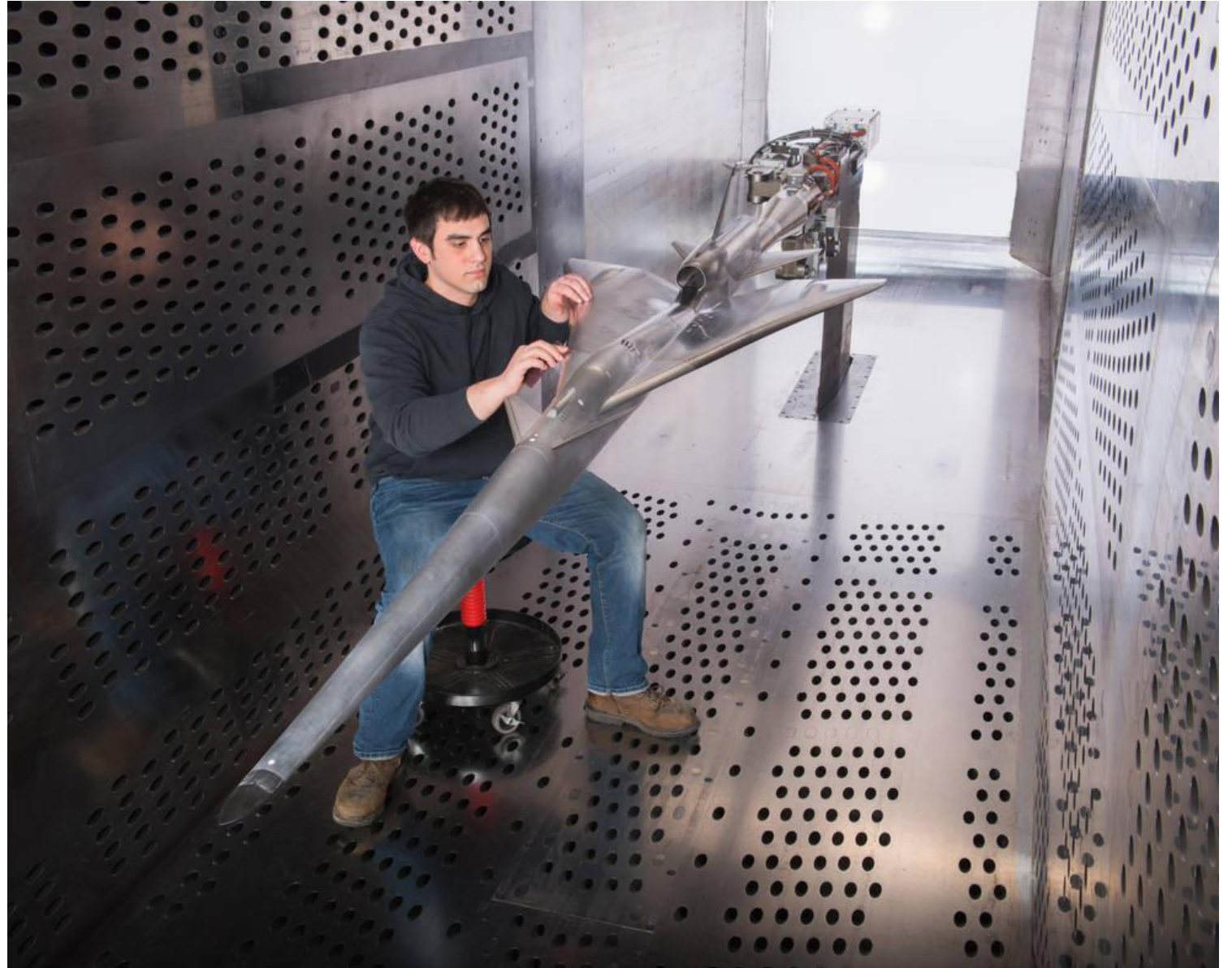
- Frequency dependence good match for fan noise
- ADP fan will be tested in Fall 2019 at multiple tunnel Mach numbers



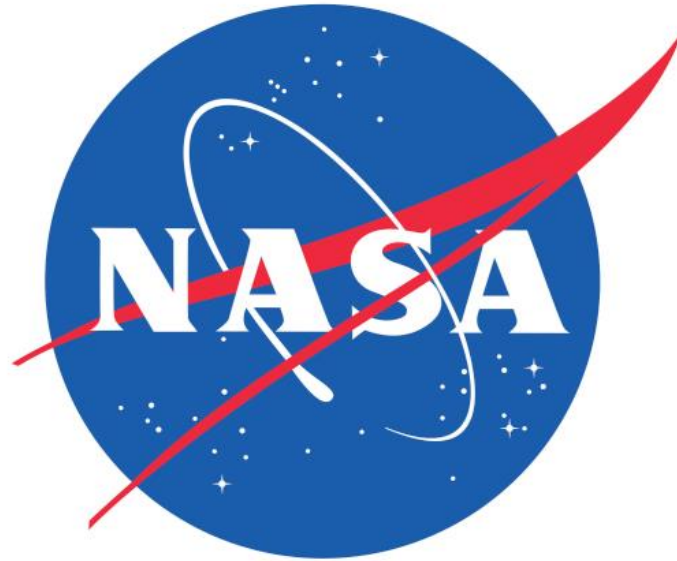


# Next Steps

- Finish installing diffuser boxes
- Low Boom Flight Demonstrator in 8x6
- Summer maintenance shutdown
- Anechoic quality testing (no flow)
- Calibration of 9x15
- New Microphone Traverse
- ADP Fan Test



# Questions?





# Summary

The 9- by 15-Foot Low Speed Wind Tunnel (9x15 LSWT) at NASA Glenn Research Center was built in 1969 in the return leg of the 8- by 6-Foot Supersonic Wind Tunnel (8x6 SWT). The 8x6 SWT was completed in 1949 and acoustically treated to mitigate community noise issues in 1950. This treatment included the addition of a large muffler downstream of the 8x6 SWT test section and diffuser.

The 9x15 LSWT was designed for performance testing of V/STOL aircraft models, but with the addition of the current acoustic treatment in 1986 the tunnel been used principally for acoustic and performance testing of aircraft propulsion systems. The present document describes the status of the acoustic upgrade as of early 2019.